Serving Imagery and Raster Data with ArcGIS Server

AGIC 2009 Technical Workshop
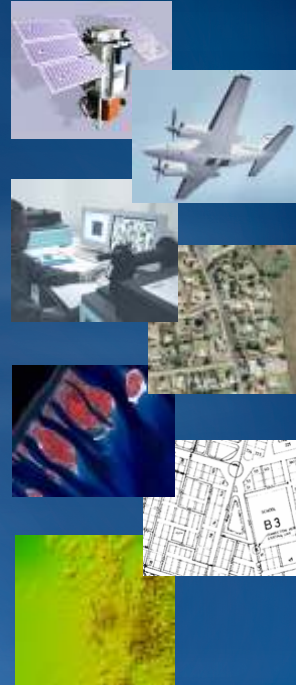*David Vaillancourt - ESRI*

Workshop Agenda

- Imagery and ArcGIS
- Image service—data, publishing, and access
- Image service ArcGIS layer properties
- Image service clients
- ArcGIS Server—Image Extension
- Authoring, managing, using image service definitions

Growth of Imagery

- **Huge volumes of imagery exist**
- **Volumes growing exponentially**
- **Multiple sources:**
  - **Satellites, digital aerial cameras, scanned film & maps**
- **Increasing image depth:**
  - **Resolution**
  - **Greater bit depths (8-12bit)**
  - **More bands (3,4,8,9,Hyperspectral)**
- **Increasingly inexpensive**

- **Problem has been accessibility!**

ArcGIS Server Family
Imagery is an integral part of a complete GIS

Use
- **Many Clients**

Desktop · Explorer · Web Map Viewer · Mobile · Open APIs · Enterprise Service Bus

Serve

Map Services · Globe Services · GeoCoding Services · GeoData Services · Analysis & Modeling Services · Image Services · Open OGC Services

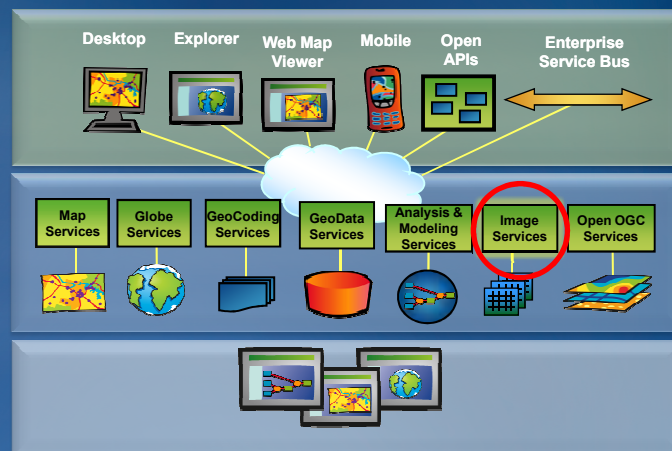**Author / Manage**
- **Desktop**

Image service—data, publishing, and access

What is an Image Service?

- Image service—an image or raster dataset, made available by a server to a client application.
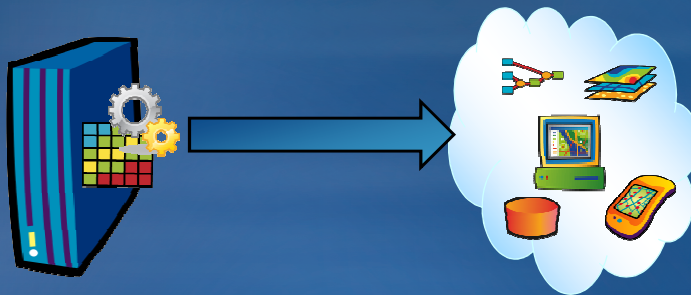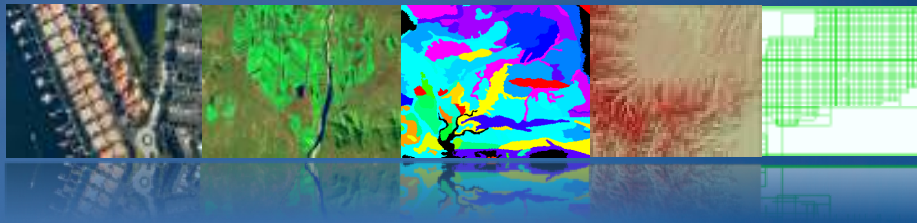
Image Service Source Data

- **Raster dataset**
  - from a geodatabase, ArcSDE, or file on disk
- **Raster dataset layer**
- **Compiled image service definition**
  - containing one or more raster datasets and defined processes
 - created using the Image extension

Publishing Image Services

- **ArcGIS Server**
  - raster dataset
  - raster dataset layer
- **ArcGIS Server + ArcGIS Image extension**
  - raster dataset
  - raster dataset layer
  - *.ISCDef
- **Image extension (stand-alone)**
  - *.ISCDef

Image Service Capabilities

- Imaging
- WMS (OGC web mapping service) service
- WCS (OGC web coverage service) service

OGC: Open Geospatial Consortium
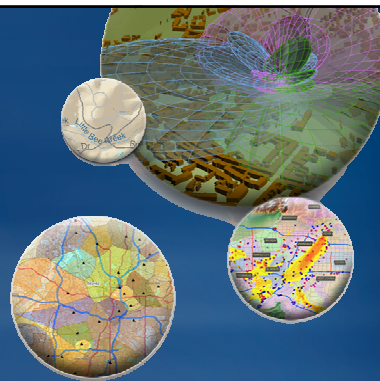
Demo:

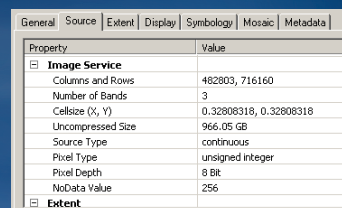**Publishing and accessing image services**

The Image Service Layer

- Similar to a raster dataset layer
- Familiar Layer Properties dialog box
- Raw pixel values are transmitted
- DEMs can be used as an ArcGlobe surface
- Image service layer can be used in a geoprocessing tool
- Can export source data, not just rendered image

Image Service Layer Properties

- Layer Properties dialog box is consistent between any type of image service and raster dataset
- 5 tabs (for all image services):
  - General
  - Source
  - Extent
  - Display
  - Symbology

- 2 additional tabs (if published from an *.iscdef):
  - Mosaic
  - Metadata
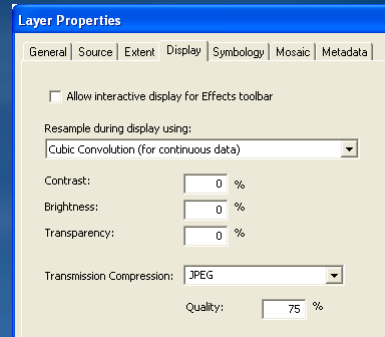- Source tab – displays data source as ArcGIS Image Service

Layer Properties: Display Tab

- **Resampling methods**
  - **Nearest neighbor**
  - **Bilinear**
  - **Cubic convolution**
  - **Majority**
- **Basic display adjustments**
  - **Contrast**
  - **Brightness**
  - **Transparency**

Layer Properties: Symbology Tab

User can change:
- **Renderer**
  - **Stretched**
  - **RGB Composite**
- **Band combinations**
- **Stretch type**
  - **None**
  - **Standard deviations**
  - **Minimum-Maximum**
- **Gamma stretch**
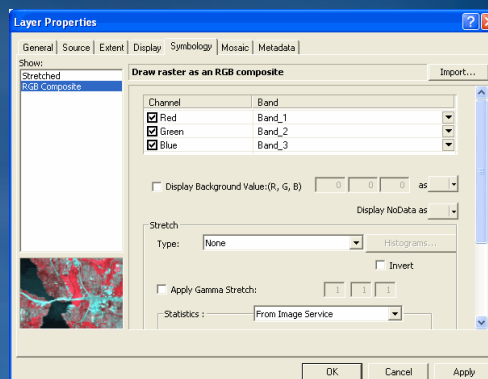
Data Export

- **Export data**
  - **Extract pixels from an image service and write them to a local file**

Export Image Server Data - WORLD_LAN_432_Cal

Extent
- ◉ Data Frame (Current)
- ○ Image Server (Original)
- ○ Selected Graphic (Clipping)

Spatial Reference
- ○ Data Frame (Current)
- ◉ Image Server (original)

Output Raster
- ☐ Use Renderer   ☐ Square: Cell Size (cx, cy): ◉ 69.99991697 69.99991697
- ☑ Force RGB   Raster Size (columns, rows): ○ 1875 1258
- NoData as:

Name	Property
Bands	3
Pixel Depth	8 Bit
Uncompressed Size	6.21 MB
Extent (left, top, right, bottom)	(-12525278.0199, 4990673.5237, -1240803 9.9022, 508141...
Spatial Reference	World_Mercator

Location: C:\Program Files\ArcGIS\bin

Name: WORLD_LAN_43   Format: IMAGINE Image

Compression Type: NONE   Compression Quality (1-100): 75
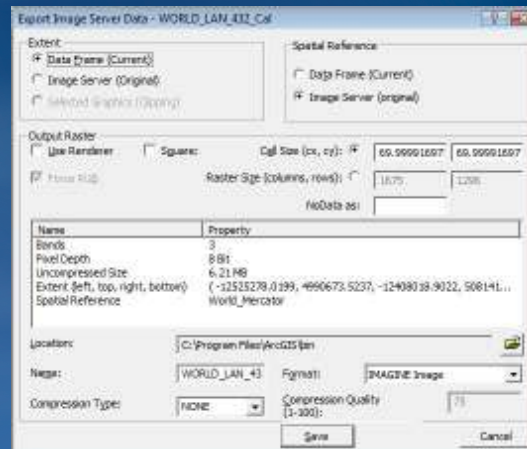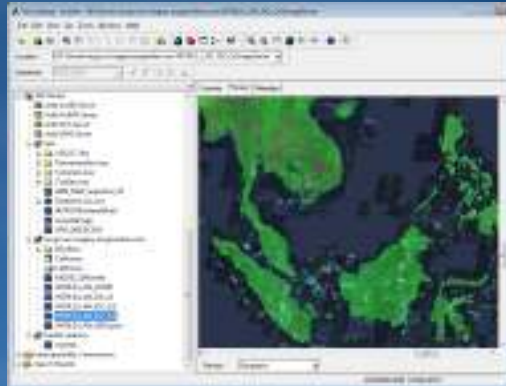
Save   Cancel

---

Image Server Clients

Using Image Services in ArcCatalog

- **View available image services in ArcGIS Server connections**
- **Administrate image services (Create, Delete, Start, Stop, etc.)**
- **Create layers and set display properties**

Using Image Services in ArcMap

- **Access to image services supported through ArcGIS Server connections**
- **Image services behave much like other raster layers**
- **Rich user experience**
- **Image services can be stored in MXDs and served as layers in Map Services**
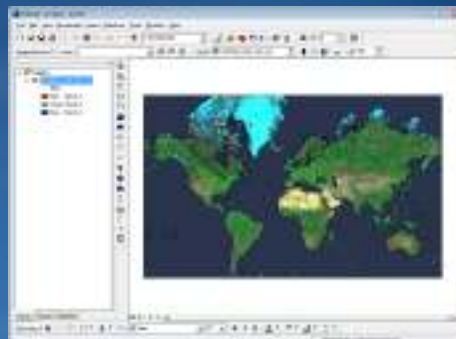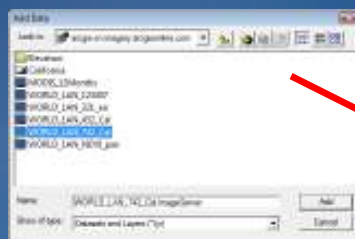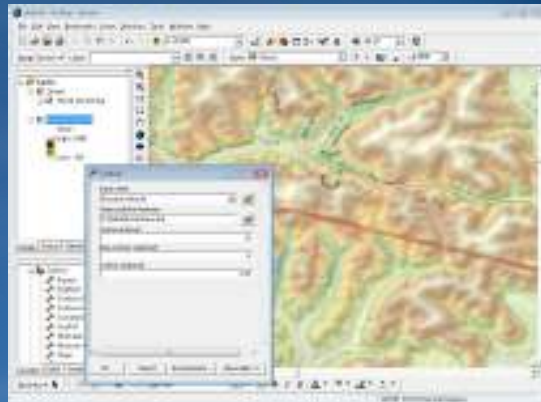
Using Image Services in ArcGlobe

- **Access to image services supported through ArcGIS Server connections**
- **Can be used as draped imagery or as elevation surfaces, depending on the data being served**
- **Same rich access to image service properties as supported in ArcMap**
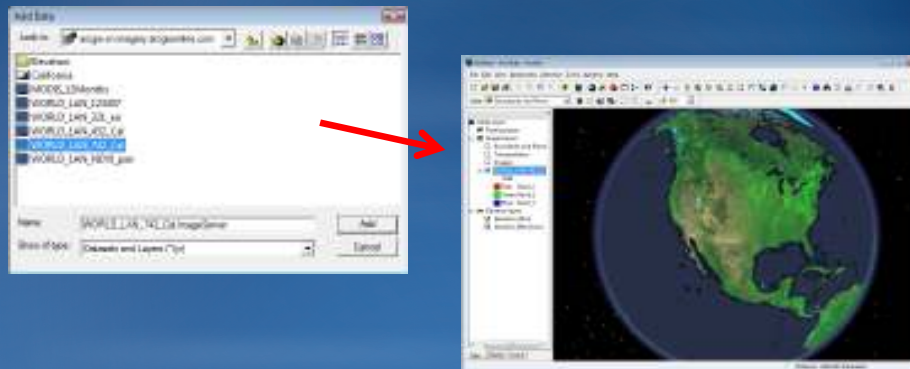
Using Image Services in Geoprocessing

- **Image services can be used in Geoprocessing tools as raster data**
- **Pixels vs. Pictures—image service configurations**
- **Caveat—a "Make Layer" step is needed when running GP Models or GP Services**

Using Image Services in ArcGIS Explorer

- **ArcGIS Explorer 900 has support for Image Services via *.lyr files!**
- **Via Globe Services**
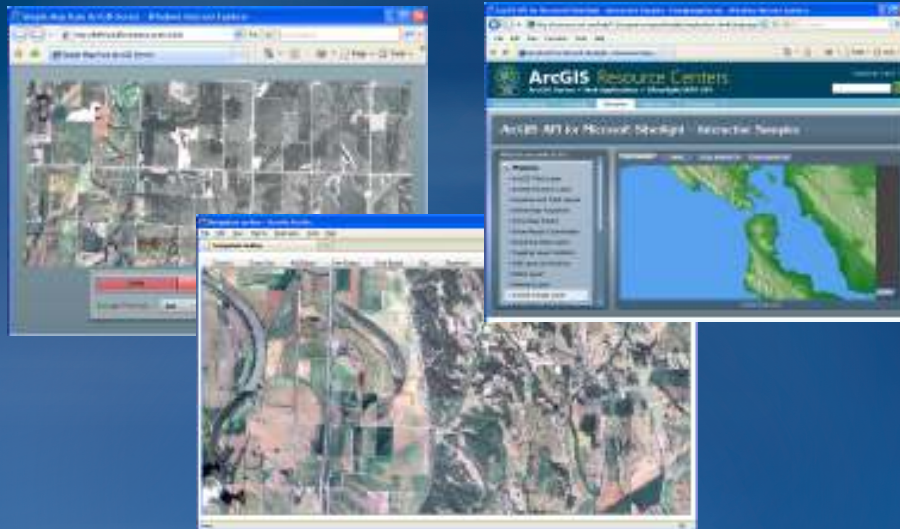- **Make great base maps for AGX**

ArcGIS Web Mapping Applications

- **WMAs built with ArcGIS Server Manager directly support image services (added at 9.3.1)**
- **Wizard allows for quick and easy configuration of the application**
- **Little to no programming required**
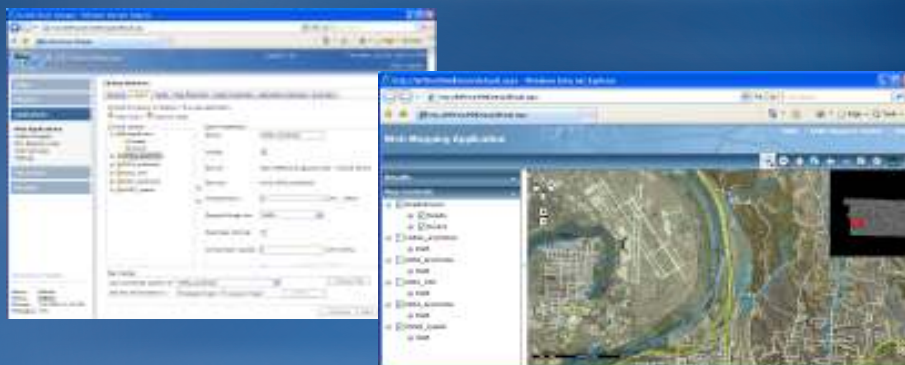
# ArcGIS Server APIs (JavsScript, Flex, Silverlight)

OGC Capabilities

- **Web Map Service (WMS)**
  - Supported for "rendered" image services
  - Useful for imagery base maps
- **Web Coverage Service (WCS)**
  - Serves actual pixel information from source data
  - Supported in many image analysis and processing software packages
  - Useful for image analysis applications where full pixel depth (bits and bands) are required
- **Configured as a capability of the image service while publishing a resource**

Demo:
Using layer properties
Using Image Services in a variety of clients
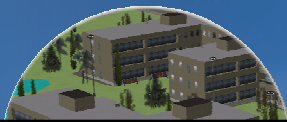
ArcGIS Server Image Extension

Image Extension - ArcGIS Image Server
Maximizes the Value of Imagery

- **Integrates directly with ArcGIS Server**
- **Enterprise wide image accessibility**
  - Increases access and use
  - Very large image datasets
  - Within GIS, CAD, imaging, and Web applications
- **Direct read of imagery in its native form**
  - Simplifies data management
  - Reduces redundancy
  - Reduce delay in making imagery accessible
- **On-the-fly server-based image processing**
  - Serves multiple customized imagery products
  - From a single source
- **End users get**
  - Fast image access
  - Optimized to their requirements
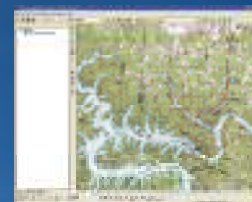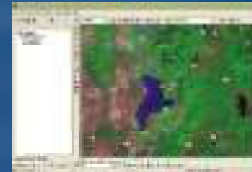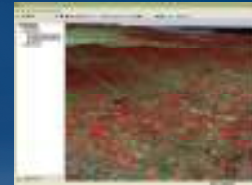 - Improved image quality
  - Important image metadata


Image Extension Paradigm
Combine Processing with Serving

- **Keep imagery in native form**
- **Author image service definition (catalog)**
  - **Properties of images**
  - **Processing to be applied**
  - **Properties of the service**
  - **Generate service overviews (optional)**
- **Publish image service**
- **Client accesses service**
  - **Client defines area of interest**
  - **Server accesses and processes imagery**
  - **Required image transmitted to client**
  - **Client displays image**

Use

Serve

Image Server

Author

Service Definition
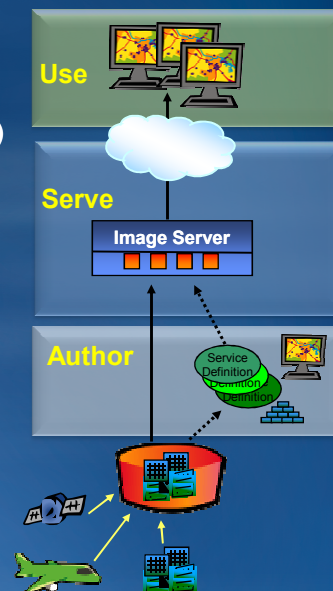
When to Use the Image Extension?
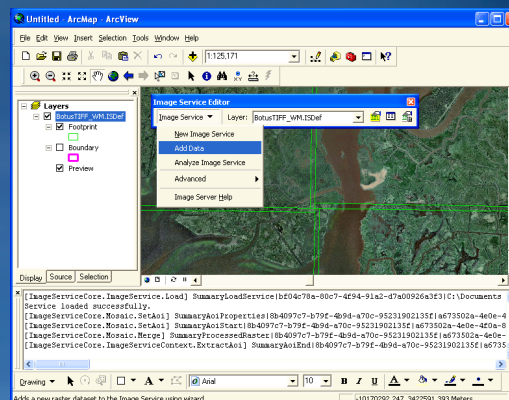
- **When you:**
  - Have multiple images
  - Do not wish to pre-mosaic
  - Need different image products
  - Exploit overlap (i.e. temporal)
  - Want image specific metadata
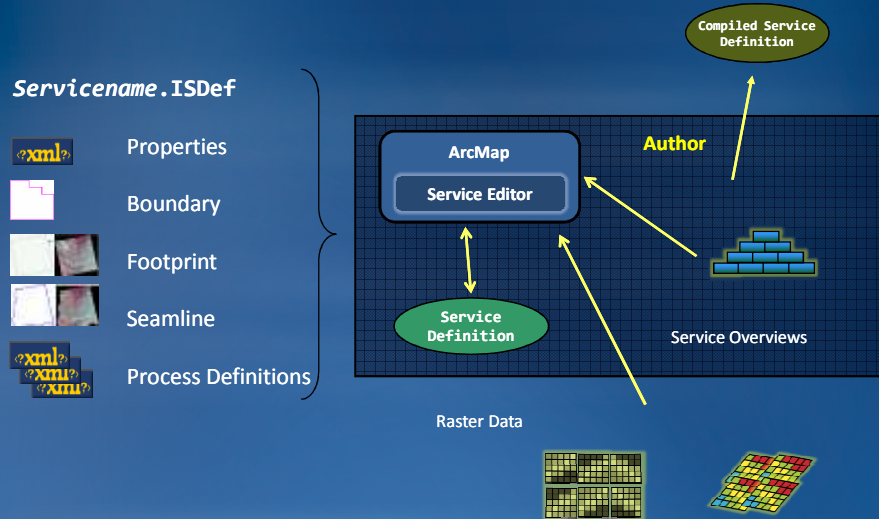 - Fast authoring and updates
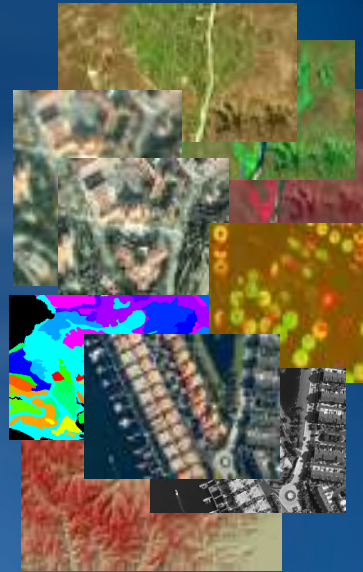
How to Author an Image Service Definition

- **Toolbar in ArcMap**
  - Define image service definition & properties
  - Add imagery or raster datasets
    - Derives footprints
    - Extracts metadata
  - Define processing
  - Optimize
  - Compile

An image service definition can contain raster datasets in various types, formats, geometry, or projections.

Authoring image service definitions

Servicename.**ISDef**

- Properties
- Boundary
- Footprint
- Seamline
- Process Definitions

Compiled Service Definition

ArcMap

Service Editor

Author

Service Definition

Service Overviews

Raster Data

Footprint & Service Table

- **Footprint**
  - **Polygon representing the extent of the valid pixel data in each image**
  - **Used to**
    - **Select raters that intersect with client AOI**
    - **Clip pixels**

- **Service Table**
  - **contains the attributes for each footprint, including:**
    - **Source raster**
    - **Low and high pixel sizes**
    - **Minimum and maximum pixel sizes**
    - **Display order**
  - **Used to filter raster datasets to be processed depending on scale prior to mosaic**
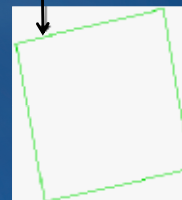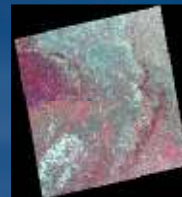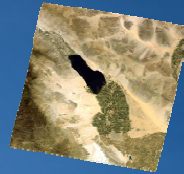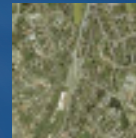
Image Service Editing: Footprint

Improved options to recompute footprints
- **By Geometry** *New at 9.3*
  - – useful for orthorectified raster datasets
- **By Radiometry** *New at 9.3*
  - – useful for data requiring a transparent boundary
- **By Clipping to Boundary** *New at 9.3*
- **By Shrinking**
- **By Related Geometry** *New at 9.3*
  - – Useful for using footprints\polygons from elsewhere

Processes

- **Enhancing image appearance**
  - – Stretching
  - – Pan-sharpen
  - – Convolution Filter
  - – Trend
- **Band organization**
  - – Extract Bands
  - – Stack Bands
- **Displaying elevation**
  - – Visualize Elevation
- **Geometric processing**
  - – Affine, Warp Grid, etc.
  - – Orthorectification

- **Applying algebra and extraction**
  - – Classify pixel
  - – Image Algebra
  - – NDVI
  - – Convert Pixel Type
  - – Histogram
- **Changing output color**
  - – Grayscale
  - – Color Map
  - – Spectral Matrix
  - – Trend

Mosaicking methods
Reorder overlapping imagery

- Closest to Center
- Closest to Nadir
- Closest to Viewpoint
- By Attribute
- Most Northwest
- Seamline
- Lock Raster

Image Service Editing: Seamlines

- Options to generate seamlines:
  - By Radiometry *New at 9.3*
    - Examines overlapping raster datasets and intelligently creates a seamline to follow natural patterns between the overlap
  - By Exporting Footprints
- Do not appear as overlapping polygons
 - Makes it easier to distinguish and edit them

Demo:

Authoring an image service definition, recompute footprints, and add service-level processes

---
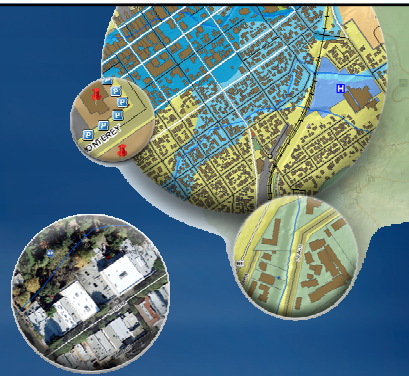
General setup and configuration

- **ArcGIS Server – regular setup**
  - License level: Standard or Enterprise

- **Configuring with Image extension**
  - ArcGIS Server – regular setup
  - Image Extension – regular setup
    - Using Image Server Manager
  - Register Image extension with ArcGIS Server
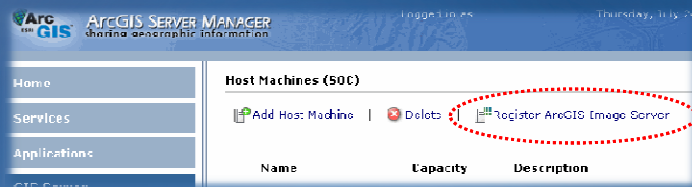
Thanks for your attention!

David Vaillancourt - ESRI